ELSEVIER

Volume 293–295, 20 December 1999

Journal of ALLOYS AND COMPOUNDS

Contents

Preface xv

Acknowledgements xvii

Part I Fundamentals

Thermodynamics, phase diagrams

General aspects

Hydrogen solution in homogeneous Pd–Fe alloys 1
W. Zhang, S. Luo, T.B. Flanagan (Burlington, VT, USA)

Absorption of hydrogen in Zr based amorphous alloys under high pressures of gaseous hydrogen 7
S.M. Filipek (Warsaw, Poland), I. Bakonyi (Budapest, Hungary), A. Szummer (Warsaw, Poland)

Two mathematical models for the hydrogen storage properties of AB_2 type alloys 10
S. Fang, Z. Zhou, J. Zhang, M. Yao, F. Feng (Shanghai, PR China), D.O. Northwood (Ontario, Canada)

High-pressure studies of Laves phase intermetallic hydrides–Adaptation of statistical thermodynamic models 14
O. Beeri, D. Cohen, Z. Gavra (Beer-Sheva, Israel), J.R. Johnson (Upton, NY, USA), M.H. Mintz (Beer-Sheva, Israel)

Thermodynamics, Thermal analysis, p-c-t isotherms

Thermodynamic properties of hydrogen in fine Pd powders 19
T. Kuji (Saitama, Japan), H. Uchida, M. Sato, W. Cui (Kanagawa, Japan)

Thermal and mechanical properties of zirconium hydride 23
S. Yamanaka, K. Yoshioka, M. Uno, M. Katsura (Osaka, Japan), H. Anada (Amagasaki, Japan), T. Matsuda, S. Kobayashi (Osaka, Japan)

Effect of the penetration of Li atoms into the Pd surface on thermodynamic properties of the Pd–H system 30
H. Uchida, M. Sato, W. Cui, T. Tabata, M. Kumagai, H. Takano, T. Kondo (Kanagawa, Japan)

Calorimetric investigation of the hydrogen interaction with $ZrCrFe_{1.2}$ 34
T.V. Ivanova, V.N. Verbetsky (Moscow, Russia)

Hydrogen dissolution into zirconium oxide 38
S. Yamanaka, T. Nishizaki, M. Uno, M. Katsura (Osaka, Japan)

Influence of interstitial oxygen on hydrogen solubility in metals 42
S. Yamanaka, Y. Fujita, M. Uno, M. Katsura (Osaka, Japan)

Study on the hydrogen solubility in UNiAl 52
S. Yamanaka, T. Iguchi, Y. Fujita, M. Uno, M. Katsura (Osaka, Japan), Y. Hoshino, W. Saiki (Ibaraki, Japan)

Stability of the hydrogen absorption and desorption plateaux in $LaNi_5$–H. Part 5: H capacity 57
E.M. Gray, T.P. Blach (Brisbane, Australia), C.E. Buckley (Perth, Australia)

Tritium aging effects in palladium on kieselguhr 62
K.L. Shanahan, J.S. Holder, J.R. Wermer (Aiken, SC, USA)

Effect of substitution on hysteresis in some high-pressure AB_2 and AB_5 metal hydrides 67
M.T. Hagström (HUT, Finland), S.N. Klyamkin (Moscow, Russia), P.D. Lund (HUT, Finland)

Crystal structure, H-ordering

Zr-based alloys and hydrides

Hydrogen ordering and H-induced phase transformations in Zr-based intermetallic hydrides 74
V.A. Yartys (Kjeller, Norway and Lviv, Ukraine), H. Fjellvåg (Kjeller and Oslo, Norway), I.R. Harris (Birmingham, UK), B.C. Hauback (Kjeller, Norway), A.B. Riabov (Lviv, Ukraine), M.H. Sørby (Kjeller and Oslo, Norway), I.Yu. Zavaliy (Lviv, Ukraine)

Elsevier Science S.A.

Structural studies of Laves phases $ZrCo(V_{1-x}Cr_x)$ with $0 \leq x \leq 1$ and their hydrides 88
J.L. Soubeyroux, D. Fruchart, A.S. Biris (Grenoble, France)

Hydrogenation behaviour, neutron diffraction studies and microstructural characterisation of boron oxide-doped Zr–V alloys . . 93
A.B. Riabov (Lviv, Ukraine), V.A. Yartys (Lviv, Ukraine, Kjeller, Norway), B.C. Hauback (Kjeller, Norway), P.W. Guegan (Birmingham, UK), G. Wiesinger (Vienna, Austria), I.R. Harris (Birmingham, UK)

TEM investigation of ZrO_2 in $Zr(Ni_{0.55}V_xMn_{0.45-x})_2$ hydrogen storage alloys 101
X.B.Zhang, X.G. Yang, X.Y. Song, Y.Q. Lei, Q.D. Wang (Hangzhou, China), Z. Zhang (Beijing, China)

Structure study on rapidly solidified hydrogen storage alloy $Zr(NiM)_{2.1}$ 107
G.L. Lü, K.Y. Shu, L.S. Chen, X.Y. Song, X.G. Yang, Y.Q. Lei, Q.D. Wang (Hangzhou, China)

Rare earth-based alloys and hydrides

Structural ordering and dynamics of LaH_{3-x} 113
T.J. Udovic (Gaithersburg, MD, USA), Q. Huang, C. Karmonik (Gaithersburg, MD and College Park, MD, USA), J.J. Rush (Gaithersburg, MD, USA)

Neutron diffraction study of the $LaNi_5$–D system during activation 118
M.P. Pitt, E.M. Gray (Brisbane, Australia), E.H. Kisi (Newcastle, Australia), B.A. Hunter (Menai, Australia)

Crystallographic study of $LaNi_{5-x}Sn_x$ $(0.2 \leq x \leq 0.5)$ compounds and their hydrides 124
J.-M. Joubert, M. Latroche (Thiais, France), R. Černý (Genève, Switzerland), R.C. Bowman Jr. (Pasadena, CA, USA), A. Percheron-Guégan (Thiais, France), K. Yvon (Genève, Switzerland)

Crystal structure and protium absorption properties of La-rich $La(Ni, M)_x$ $(x=3–4.7)$ (M=Al, Co, Mn, Si) melt-spun ribbons . 130
M. Okada, T. Kuriiwa, T. Tamura, A. Kamegawa, H. Takamura (Sendai, Japan)

Observation of a continuous phase transformation in $LaNi_5$–D 135
E.M. Gray (Brisbane, Australia), E.H. Kisi (Callaghan, Australia), R.I. Smith (Didcot, UK)

Microstructures and defect structures in intermetallic compounds in the La–Ni alloy system 140
H. Inui, T. Yamamoto, Z. Di, M. Yamaguchi (Kyoto, Japan)

Mg-based alloys and hydrides

Structural studies of disordered Mg_2NiH_4 formed by mechanical grinding 146
E.Rönnebro (Stockholm, Sweden), J.O. Jensen (Lyngby, Denmark), D. Noréus (Stockholm, Sweden), N.J. Bjerrum (Lyngby, Denmark)

V-based alloys and hydrides

The intrinsic degradation behavior of $(V_{0.53}Ti_{0.47})_{0.925}Fe_{0.075}$ alloy during temperature-induced hydrogen absorption-desorption cycling 150
J.-G. Park, D.-M. Kim, K.-J. Jang, J.-S. Han, K. Cho, J.-Y. Lee (Taejon, South Korea)

Phase composition and the effect of thermal cycling for VH_x, $V_{0.995}C_{0.005}H_x$, and $V_{0.975}Zr_{0.020}C_{0.005}H_x$ 156
J.S. Cantrell (Oxford, OH USA), R.C. Bowman Jr. (Pasadena, CA, USA)

Other alloys and hydrides

Hydrogen-induced rearrangements in Pd-rich alloys 161
T.B. Flanagan (Burlington, VT, USA), C.-N. Park (Kwangju, South Korea)

Neutron diffraction study of the new hexagonal laves phase $(Hf,Ti)(Ni,V)_2$ and its deuteride 169
E. Rönnebro, D. Noréus (Stockholm, Sweden), M. Tsukahara (Aichi, Japan), T. Sakai (Osaka, Japan)

In situ measurement of lattice parameter change on Pd and Ni during cathodic hydrogen charging 174
N. Tsukuda, K. Itoh, N. Morioka, H. Ohkubo, E. Kuramoto (Fukuoka, Japan)

Crystal and magnetic structure of TbNiAl-based deuterides, $TbNiAlD_{0.30}$ and $TbNiAlD_{1.04}$, studied by neutron diffraction and synchrotron radiation 178
B.C. Hauback (Kjeller, Norway), H. Fjellvåg (Kjeller and Oslo Norway), L. Pålhaugen, V.A. Yartys (Kjeller, Norway and Lviv, Ukraine), K. Yvon (Genève, Switzerland)

Systematic B-metal substitution in $CaNi_5$ 185
J.O. Jensen, N.J. Bjerrum (Lyngby, Denmark)

Electronic structure, electric magnetic and optical properties

Electronic structure

Electronic structure and stability of hydrides of intermetallic compounds 190
M. Gupta (Orsay, France)

Chemical structure and bonding characteristics of metal hydrogen systems studied by the surface analytical techniques SIMS and XPS 202
H. Züchner, J. Kintrup, R. Dobrileit, I. Untiedt (Münster, Germany)

Electronic structure and hydriding property of titanium compounds with CsCl-type structure 213
T. Nambu, H. Ezaki, H. Yukawa, M. Morinaga (Suzuka and Nagoya, Japan)

Electronic structure of $BaReH_9$ 217
E. Orgaz, M. Gupta (Orsay-Cedex, France)

Roles of the hydride forming and non-forming elements in hydrogen storage alloys 222
K. Nakatsuka, M. Yoshino, H. Yukawa, M. Morinaga (Nagoya, Japan)

Chemical bond state and hydride stability of hydrogen storage alloys 227
H. Yukawa, T. Matsumura, M. Morinaga (Nagoya, Japan)

Calculation of the radial distribution function of bubbles in the aluminum hydrogen system 231
C.E.Buckley (Perth, Australia), H.K. Birnbaum (Urbana, Il, USA), D. Bellmann, P. Staron (Geesthacht, Germany)

Magnetic properties

The influence of hydrogen on the magnetic properties and electronic structures of intermetallic compounds: YFe_2–D_2 system as an example 237
V. Paul-Boncour, A. Percheron-Guégan (Thiais, France)

Magnetic properties of intermetallic compound hydrides and deuterides 243
F. Ishikawa, I. Yamamoto, M. Yamaguchi, Y. Shimazu (Yokohama, Japan), T. Goto, H. Mitamura (Tokyo, Japan)

The synthesis and magnetic properties of $LaCo_{13}$ hydrides and nitrides 247
S.A. Nikitin, I.S. Tereshina, V.N. Verbetsky, A.A. Salamova, B.I. Lazoryak, V.A. Morozov (Moscow, Russia)

Electromotive force of metal hydride electrodes in gradient magnetic fields 251
I. Yamamoto, M. Fujino, M. Yamaguchi, F. Ishikawa (Yokohama, Japan), T. Goto (Tokyo, Japan), S. Miura (Sendai, Japan)

Magnetic properties of commercial metal hydride battery materials 255
D.P. Broom, M. Kemali, D.K. Ross (Salford, UK)

H-diffusion, Tunneling, trapping, mobility

Theoretical work

A BPP model for nuclear spin relaxation in disordered metal–hydrogen systems 260
L.M. Cameron, C.A. Sholl (Armidale, Australia)

Muon–proton correlated diffusion in TiH_x 266
J. Lam, J.M. Titman (Sheffield, UK)

Protium diffusion in La–Ni alloys 270
K. Gunji, H. Takamura, M. Okada, Y. Iijima (Sendai, Japan)

Local and long-range hydrogen diffusion in $Nb(OH)_{0.011}$ 275
K. Cornell, H. Wipf (Darmstadt, Germany), J.C. Cook, G.J. Kearley (Grenoble, France), K. Neumaier (Garching, Germany)

Determination of hydrogen diffusivity by subscale microhardness profiling 279
R. Balasubramaniam (Kanpur, India)

Multi-layer problems in time-lag measurements applied on metal–hydrogen systems 282
H. Züchner, L. Opara, H. Barlag (Münster, Germany)

Coherency stresses and deuterium diffusion in $NbD_{0.33}$ 289
U. Stuhr (Villigen, Switzerland), K. Cornell, H. Wipf (Darmstadt, Germany)

Muon diffusion in metallic hydride systems 292
M. Kemali, D.K. Ross, S.I. Campbell (Salford, UK)

Monte Carlo simulation of hydrogen diffusion in C15 Laves phase intermetallic compounds 296
D.J. Bull, D.K. Ross (Salford, UK)

A Born-Mayer approach to the hydrogen potential in C-15 Laves phase compounds 300
J.F. Fernandez (Madrid, Spain), M. Kemali, D.K. Ross (Salford, UK), C. Sanchez (Madrid, Spain)

Diffusion in different systems under special conditions, including diffusion in steel and oxide

Some microstructural aspects of hydriding internally oxidized Pd–Al alloys 306
R. Balasubramaniam (Kanpur, India), R. Kirchheim (Göttingen, Germany), D. Wang, T. Flanagan (Burlington, VT, USA)

Nature of hydrogen trapping sites in steels induced by plastic deformation 310
M. Nagumo, K. Takai, N. Okuda (Tokyo, Japan)

A visible technology for display of hydrogen distribution in metals 317
M. Au (Longmont, CO, USA)

Influence of neutron irradiation on H diffusion in Zr–2.5Nb alloy 324
D. Khatamian, A. Shaddick, V.F. Urbanic (Chalk River, Canada)

Hydrogen permeation through magnesium 329
C. Nishimura, M. Komaki, M. Amano (Ibaraki, Japan)

Dynamics of hydrogen in scandium and yttrium by acoustic spectroscopy 334
F. Trequattrini (Roma, Italy), G. Cannelli (Cosenza, Italy), R. Cantelli, F. Cordero (Roma, Italy), O. Florêncio (Saö Carlos-S.P, Brazil)

H and D tunnelling systems in diluted $Nb_{1-x}Zr_x$ alloys 338
F. Cordero (Roma, Italy), G. Cannelli (Calabria, Italy), R. Cantelli, F. Trequattrini (Roma, Italy)

Migration of hydrogen in yttrium at low temperatures 341
K. Yamakawa, H. Maeta (Matsuyama and Ibaraki, Japan)

Neutron scattering diffusion studies

The use of small angle neutron scattering in the study of hydrogen trapping at defects in metals 346
D.K. Ross, K. Stefanopoulos, M. Kemali (Salford, UK)

Quasi-elastic neutron scattering study of the hydrogen diffusion in the C15 Laves structure, $TiCr_{1.85}$ 351
S.I. Campbell (Oxon and Salford, UK), M. Kemali, D.K. Ross, D.J. Bull (Salford, UK), J.F. Fernandez (Madrid, Spain), M.R. Johnson (Grenoble, France)

Surface and interface effects

Hydrogen surface effects in ferritic stainless steels 356
A. Szummer, E. Jezierska, K. Lublińska (Warsaw, Poland)

A new method for two-dimensional hydrogen analysis and its application to metal surfaces 361
K. Ueda, K. Ishikawa, M. Yoshimura (Nagoya, Japan)

A duplicated fluorination technique for hydrogen storage alloys 364
Y.-M. Sun, X.-P. Gao, N. Araya, E. Higuchi, S. Suda (Tokyo, Japan)

Effect of LiOH pretreatment on H_2 absorption kinetics of $LaNi_5$ 369
H.-H. Uchida, Y. Ozu, K. Suzuki, S. Kubo, A. Yoshizawa (Hiratsuka, Japan)

Improvement of the activation stage of $MmNi_{4.7}Al_{0.3}$ hydride-forming alloys by surface fluorination 374
D.S. Rodriguez, G. Meyer (S.C. de Bariloche, Argentina)

Reaction kinetics

Kinetics and morphology of the reverse $\beta \rightarrow \alpha$ hydride transformation in thermodynamically open Pd–H system 379
M.V. Goltsova, Yu.A. Artemenko, V.I. Zaitsev (Donetsk, Ukraine)

Evaluation of kinetics by utilizing the normalized pressure dependence method for the alloy $Ti_{0.95}Zr_{0.05}Mn_{1.48}V_{0.43}Fe_{0.08}Al_{0.01}$ 385
V.M. Skripnyuk, M. Ron (Haifa, Israel)

Dynamic P-c-T relations of the La-incorporated/fluorinated AB_2 hydriding alloys 391
S. Suda, M. Imai, M. Uchida, Y. Komazaki, E. Higuchi (Tokyo, Japan)

Local dynamics of H and D trapped by substitutional dopants in semiconductors 396
G. Cannelli (Cosenza, Italy), R. Cantelli, F. Cordero, F. Trequattrini, E. Giovine (Roma, Italy)

Catalysed reactive milling 400
P. Tessier, E. Akiba (Ibaraki, Japan)

The effect of O_2 preadsorption on the rate of H_2 absorption on the surface of rare earths (La, Ce, Tb, Dy) at 298 K 403
M. Hadano, N. Urushihara, T. Inoue, H. Uchida (Kanagawa, Japan)

Hydrogen desorption kinetics of hydrides of $LaNi_{4.5}Al_{0.5}$, $LaNi_{4.5}Mn_{0.5}$ and $LaNi_{2.5}Co_{2.5}$ 407
T. Haraki, N. Inomata, H. Uchida (Kanagawa, Japan)

Hydrogen absorption and desorption by Ti, Ti-5Cr and Ti-5Ni alloys 412
S.-J. Gao, L.-J. Huang (Shenyang, People's Republic of China)

Part II Materials

New materials hydride, new properties and new phenomena, new methods

New metal hydrides

Hydrogen absorption and desorption properties of Hf-based intermetallic compounds 417
D. Mukai (Hiroshima, Japan), H. Miyata (Hokkaido, Japan), K. Aoki (Hiroshima, Japan)

Synthesis and properties of multicomponent hydrides with high density 421
V.N. Verbetsky, S.V. Mitrokhin, E.A. Movlaev (Moscow, Russia)

Pseudobinary intermetallic compounds in Hf_2M'–Hf_2M'' (M′, M″=Mn, Fe, Ni, Cu) systems and their interaction with hydrogen at high pressures 426
S.N. Klyamkin, K.N. Semenenko (Moscow, Russia)

Hydride formation in Ce(La)–Ni–Si ternary compounds 429
S.A. Lushnikov, S.N. Klyamkin, A.V. Morozkin, V.N. Verbetsky (Moscow, Russia)

New V-based alloys with high protium absorption and desorption capacity 433
T. Kuriiwa, T. Tamura, T. Amemiya, T. Fuda, A. Kamegawa, H. Takamura, M. Okada (Sendai, Japan)

New properties and new phenomena

Hydriding properties of the MgNi-based systems 437
S. Orimo (Stuttgart, Germany), A. Züttel (Perolles, Switzerland), K. Ikeda (Higashi-Hiroshima, Japan), S. Saruki (Nagoya, Japan), T. Fukunaga (Osaka, Japan), H. Fujii (Higashi-Hiroshima, Japan), L. Schlapbach (Perolles, Switzerland)

Enhancement of hydrogen solubility in α-iron by coherent precipitates 443
H. Miyamura, K. Nakamura, S. Kikuchi (Shiga, Japan), N. Mazaki, H. Kuwahara (Kyoto, Japan)

New methods

Silica embedded metal hydrides 446
L.K. Heung, G.G. Wicks (Aiken, SC, USA)

The structural peculiarities of the transition metals carbohydrides produced by combustion synthesis 452
S.K. Dolukhanyan, N.N. Aghajanyan, H.G. Hakobyan, V.Sh. Shekhtman, O.P. Ter-Galstyan (Yerevan, Armenia)

The effect of novel processing on hydrogen uptake in FeTi- and magnesium-based alloys 458
S. Morris, S.B. Dodd (Hants, UK), P.J. Hall, A.J. Mackinnon, L.E.A. Berlouis (Glasgow, UK)

Thin film, multilayers and clusters

Hydrogen ion implantation effect on the magnetic properties of metallic multilayered films 463
Y. Hayashi, M. Masuda, K. Tonomyo, S. Matsumoto, N. Mukai (Fukuoka, Japan)

In situ monitoring of hydrogen absorption–desorption in Pd and $Pd_{77}Ag_{23}$ films by an electrochemical quartz crystal microbalance 468
S.-Y. Liu (Hsinchu, Taiwan), Y.-H. Kao, Y.O. Su (Taipei, Taiwan), T.-P. Perng (Hsinchu, Taiwan)

Pd-cluster size effects of the hydrogen sorption properties 472
A. Züttel, Ch. Nützenadel (Fribourg, Switzerland), G. Schmid (Essen, Germany), D. Chartouni, L. Schlapbach (Fribourg, Switzerland)

Hydrogen in thin epitaxial Nb films 476
G. Song, A. Remhof, D. Labergerie, C. Sutter, H. Zabel (Bochum, Germany)

Hydrogen sorption in elastically soft stabilized Pd-clusters 480
A. Pundt, C. Sachs (Göttingen, Germany), M. Winter, M.T. Reetz (Mühlheim/Ruhr, Germany), D. Fritsch (Geesthacht, Germany), R. Kirchheim (Göttingen, Germany)

In situ study of hydriding–dehydriding properties in some Pd/Mg thin films with different degree of Mg crystallization 484
K. Higuchi, H. Kajioka, K. Toiyama (Kure, Japan), H. Fujii, S. Orimo (Higashi-Hiroshima, Japan), Y. Kikuchi (Chigasaki, Japan)

Hydrogen-induced stress in Nb single layers 490
U. Laudahn, A. Pundt, M. Bicker, U. v. Hülsen, U. Geyer (Göttingen, Germany), T. Wagner (Stuttgart, Germany), R. Kirchheim (Göttingen, Germany)

Nanocrystalline, amorphous and composite materials

Nanocrystalline, amorphous materials

Structural study and hydrogen sorption kinetics of ball-milled magnesium hydride 495
J. Huot (Varennes, Canada), G. Liang (Ste-Foy, Canada), S. Boily (Varennes, Canada), A. Van Neste (Ste-Foy, Canada), R. Schulz (Varennes, Canada)

Structural investigation and solid-H_2 reaction of Mg_2Ni rich nanocomposite materials elaborated by mechanical alloying 501
M.Abdellaoui (Tunis, Tunisia), D. Cracco, A. Percheron-Guegan (Thiais, France)

Advanced nanocrystalline Zr-based AB_2 hydrogen storage electrode materials for NiMH EV batteries 508
L. Chen (Shenyang, People's Republic of China), F. Wu (Zhongshan, People's Republic of China), M. Tong, D.M. Chen, R.B. Long (Shenyang, People's Republic of China), Z.Q. Shang (Zhongshan, People's Republic of China), H. Liu, W.S. Sun, K. Yang, L.B. Wang, Y.Y. Li (Shenyang, People's Republic of China)

Improvement of hydrogen storage properties of melt-spun Mg–Ni–RE alloys by nanocrystallization 521
K. Tanaka, Y. Kanda, M. Furuhashi, K. Saito, K. Kuroda, H. Saka (Nagoya, Japan)

Hydrogen absorption properties of amorphous and crystalline alloys in the pseudobinary ZrCo–TiNi system 526
E. Shimizu (Sendai, Japan), K. Aoki (Hokhaido, Japan), T. Masumoto (Sendai, Japan)

Microstructure and hydrogen absorption properties of nano-phase composite prepared by mechanical alloying of $MmNi_{5-x}(CoAlMn)_x$ and Mg 531
M. Zhu, W.H. Zhu (Guangzhou, People's Republic of China), C.Y. Chung (Kowloon, Hong Kong), Z.X. Che, Z.X. Li (Guangzhou, People's Republic of China)

Mg_2Ni hydride electrodes prepared by sintering and subsequent ball milling with Ni powders 536
L. Sun, P. Yao, H.K. Liu, D.H. Bradhurst, S.X. Dou (Wollongong, Australia)

Synthesis and hydriding/dehydriding properties of amorphous $Mg_2Ni_{1.9}M_{0.1}$ alloys mechanically alloyed from $Mg_2Ni_{0.9}M_{0.1}$ (M=none, Ni, Ca, La, Y, Al, Si, Cu and Mn) and Ni powder 541
N. Terashita, M. Takahashi, K. Kobayashi, T. Sasai, E. Akiba (Ibaraki, Japan)

Hydriding properties of the heat-treated MgNi alloys with nanostructural designed multiphase 546
K. Yamamoto, S. Orimo, H. Fujii (Higashi-Hiroshima, Japan), Y. Kitano (Matsue, Japan)

Electrochemical and structural characteristics of amorphous $MgNi_x$ ($x \geq 1$) alloys prepared by mechanical alloying 552
S.G. Zhang, Y. Hara, T. Morikawa, H. Inoue, C. Iwakura (Osaka, Japan)

Electrochemical characteristics of nanocrystalline $ZrCr_2$ and Mg_2Ni type metal hydrides prepared by mechanical alloying . . . 556
J.H. Woo, C.B. Jung, J.H. Lee, K.S. Lee (Seoul, South Korea)

Composite materials

Hydrogen-absorbing magnesium composites prepared by mechanical grinding with graphite: effects of additives on composite structures and hydriding properties 564
H. Imamura, Y. Takesue, T. Akimoto, S. Tabata (Ube, Japan)

Part III Applications

Negative electrode alloys, MH-electrodes, H-insertion electrodes

Negative electrode alloys

The correlation between composition and electrochemical properties of metal hydride electrodes 569
J.J. Reilly, G.D. Adzic, J.R. Johnson, T. Vogt, S. Mukerjee, J. McBreen (Upton, NY, USA)

A review on the development of AB_2-type Zr-based Laves phase hydrogen storage alloys for Ni–MH rechargeable batteries in the Korea Advanced Institute of Science and Technology 583
D.-M. Kim, K.-J. Jang, J.-Y. Lee (Taejon, South Korea)

Electrochemical properties and characteristics of a fluorinated AB_2-alloy 593
Z.P. Li, E. Higuchi, B.H. Liu, S. Suda (Tokyo, Japan)

The effect of annealing on the discharge characteristics of $ZrV_{0.7}Mn_{0.5}Ni_{1.2}$ alloy 601
S.-M. Lee, J.-S. Yu, H. Lee, K.-J. Jang, J.-Y. Lee (Taejon, South Korea)

Effects of cooling rate during casting on performance of metal hydride electrodes and nickel–metal hydride batteries 608
L.Y. Zhang, M. Klein, B. Czajkowski, L. Huston (Gainesville, FL, USA), R. Pechloff (Nuremberg, Germany), D. Chen, K. Yang (Shenyang, PR China)

The improvement of the hydrogenation properties of nickel-metal hydride battery alloy by surface modification with platinum group metals (PGMs) 613
D.B. Willey (Birmingham and Reading, UK), I.R. Harris (Birmingham, UK), A.S. Pratt (Reading, UK)

Electrochemical characteristics of AB_5-type hydrogen storage alloys solidified at different cooling rates 621
L.Y. Zhang (Gainesville, FL, USA)

Charge and discharge characteristics of sintered Mg_2Ni 626
K. Watanabe, W.M. Shu, K. Mizukami, K. Kobayashi, Y. Hatano, S. Morozumi (Toyama, Japan)

Contribution of rare-earths to activation property of Zr-based hydride electrodes 632
X.G. Yang, Y.Q. Lei, K.Y. Shu, G.F. Lin, Q.A. Zhang, W.K. Zhang, X.B. Zhang, G.L. Lu, Q.D. Wang (Zhejiang, China)

Influence of cobalt content in $MmNi_{4.3-x}Mn_{0.3}Al_{0.4}Co_x$ alloy (x=0.36 and 0.69) on its electrochemical behaviour studied by in situ neutron diffraction 637
M. Latroche, A. Percheron-Guégan (Thiais, France), Y. Chabre (Saint Martin d'Hères, France)

Electrochemical properties of mechanically ground Mg_2Ni alloy 643
T. Kohno, M. Yamamoto, M. Kanda (Kawasaki, Japan)

Studies on the electrochemical properties of $MlNi_{4.3-x}Co_xAl_{0.7}$ hydride alloy electrodes 648
H.G. Pan, J.X. Ma, C.S. Wang, S.A. Chen, X.H. Wang, C.P. Chen, Q.D. Wang (Hangzhou, People's Republic of China)

A new electrode material for nickel–metal hydride batteries: MgNi–graphite composites prepared by ball-milling 653
C. Iwakura, H. Inoue, S.G. Zhang, S. Nohara (Osaka, Japan)

Segregation control for the preparation of rare earth based hydrogen storage alloys 658
S.E. Hsu, M.T. Yeh, I.C. Hsu, J.Y. Wang, V. Beibutian (Taiwan, China)

About the mechanism and the rate limiting step of the metalhydride electrode reaction 663
A. Züttel (Fribourg, Switzerland), V. Güther, A. Otto (Nürnberg, Germany), M. Bärtsch, R. Kötz (Villigen, Switzerland), D. Chartouni, Ch. Nützenadel, L. Schlapbach (Fribourg, Switzerland)

Modification of a rapidly solidified hydrogen storage electrode alloy by ball-milling with Co_3Mo 670
K. Yang, D.M. Chen, L. Chen, H.F. Zhang, W.S. Sun, Y.Y. Li (Shenyang, China)

Mg_2Ni-based hydrogen storage alloys for metal hydride electrodes 675
J. Chen, P. Yao, D.H. Bradhurst, S.X. Dou, H.K. Liu (Wollongong, Australia)

Influence of concentration of KOH solution containing 0.02 M borohydride on the kinetic properties of hydrogen storage alloys 680
H.G. Pan, Y. Chen, C.S. Wang, X.H. Wang, C.P. Chen, Q.D. Wang (Hangzhou, PR China)

Effects of the content of Mg impurity on the electrochemical properties of $Ml(NiCoMnTi)_5$ hydrogen storage alloy 684
L.X. Chen, Y.Q. Lei (Hangzhou, PR China), G.M. Zhu (Xiamen, PR China), H.G. Pan, K. Ren (Hangzhou, PR China), Z.Z. Li (Shijiazhuang, PR China), X.G. Yang, Q.D. Wang (Hangzhou, PR China)

Effect of advanced alkaline treatment on the electrochemical characteristics of hydrogen storage alloys 687
Y. Li, L.J. Jiang, Z. Huang, F. Zhan, B.R. Wu, Z.H. Xia, Y.J. Qiao, X.Y. Wei, G.R. Qing, X.X. Yuan (Beijing, PR China)

Influences of annealing heat treatment on phase structure and electrochemical properties of $Zr(MnVNi)_2$ hydrogen storage alloys 691
W.K. Zhang, C.A. Ma, X.G. Yang, Y.Q. Lei, Q.D. Wang, G.L. Lu (Hangzhou, PR China)

Hydrogen extraction by Laves phase alloys in an alkaline solution containing hydrazine 698
H. Nakano (Shizuoka, Japan), S. Wakao (Tokyo, Japan), H. Yoshinaga (Kyoto, Japan)

Improvement of the electrochemical properties of Zr-based AB_2 alloys by an advanced fluorination technique 702
B.-H. Liu, Z.-P. Li, E. Higuchi, S. Suda (Tokyo, Japan)

Electrochemical properties and characteristics of the fluorinated $Zr_{0.9}Ti_{0.1}V_{0.2}Mn_{0.6}Ni_{1.3}La_{0.05}$ electrode 707
X.-P. Gao, Y.-M. Sun, E. Higuchi, E. Toyoda, S. Suda (Tokyo, Japan)

Properties of $Zr_{0.5}Ti_{0.5}V_{0.75}Ni_{1.25}$ alloy ball-milled with nanocrystalline $LaNi_5$ powder 712
Z. Chen, Z. Chen, K. Huang, P. Huang (Changsha, PR China)

Influence of carbon on electrode properties of V–Ti–Ni type hydrogen storage alloy 716
J. Shi (Tokyo, Japan), M. Tsukahara (Aichi, Japan), H.T. Takeshita, N. Kuriyama, T. Sakai (Osaka, Japan)

Effect of Mo additive on hydrogen absorption of rare-earth based hydrogen storage alloy 721
M.T. Yeh, V.M. Beibutian, S.E. Hsu (Taipei-Hsian, China)

Electrochemical performance of Sn-substituted, $LaNi_5$-based rapidly solidified alloys 724
D.M. Chen, L. Chen, K. Yang, M. Tong, R.B. Long, W.S. Sun, Y.Y. Li (Shenyang, People's Republic of China)

Effects of pretreatments on the electrochemical properties of $MlNi_{4.0}Co_{0.6}Al_{0.4}$ alloy electrode and the performance of a Ni/Metal hydride battery 728
W.X. Chen, J.Q. Qi, Y. Chen, C.P. Chen, Q.D. Wang (Hangzhou, People's Republic of China), J.M. Zhou (Zhongshan, People's Republic of China)

Development of fast kinetics metal hydride alloys and battery electrodes for high power applications 734
A. Otto, V. Güther (Nuremberg, Germany)

Degradation mechanism of the misch metal alloy hydride electrodes 737
B.J. Xia, P.F. Shi, G.P. Yin, D. Zhou (Harbin, People's Republic of China)

Comparison of the electrochemical properties of cast and melt-spun $MLNi_{4.3-x}Co_xMn_{0.4}Al_{0.3}$ (ML: La-rich Mischmetal) hydrogen-storage alloys 742
C.-J. Li, X.-L. Wang, C.Y. Wang (Beijing, People's Republic of China)

In-situ and ex-situ characterization of surface oxide films on AB_5-type metal hydride electrodes 747
J.M. Nan, Y. Yang, J.K. You, X.Q. Li, Z.G. Lin (Xiamen, People's Republic of China)

Effect of alakaline pretreatments (KOH, NaOH, LiOH) on electrochemical hydriding rate and work function of $LaNi_{2.5}Co_{2.5}$. 751
H. Uchida, K. Yamashita, T. Tabata, H.H. Uchida, M. Iwase, Y. Katoh (Kanagawa, Japan)

Effect of rapid solidification process on the alloy structure and electrode performance of $Zr(Ni_{0.55}V_{0.1}Mn_{0.3}Cr_{0.55})_{2.1}$ 756
K. Shu, Y. Lei, X. Yang, G. Lin, Q. Wang, G. Lü, L. Chen (Hangzhou, PR China)

Electrochemical cells

Ni/MH batteries

R&D on metal hydride materials and Ni–MH batteries in Japan 762
T. Sakai, I. Uehara, H. Ishikawa (Osaka, Japan)

Performance of an AB_2 alloy in sealed Ni–MH batteries for electric vehicles: quantification of corrosion rate and consequences on the battery performance 770
B. Knosp, L. Vallet, P. Blanchard (Marcoussis, France)

Preparation of an improved positive electrode and its application in Ni/MH batteries 775
D.Y. Yan, J. Wang (Tianjin, PR China)

Preparation and properties of no-binder electrode Ni/MH battery 780
D. Yan, W. Cui (Tianjin, PR China)

Study of preparation technology for high performance AA size Ni–MH batteries 784
C.Z. Yu, W.H. Lai, G.J. Yan, J.Y. Wu (Beijing, P.R. China)

Effect of state of charge on impedance spectrum of sealed Ni–MH cells 788
S.Y. Wang (Hunan, China), B. Liu, J. Yan, H.T. Yuan, D.Y. Song, Y.S. Zhang (Tianjin, China)

Degradation behavior of foamed nickel positive electrodes of Ni–MH batteries 795
Z.Q. Zhou, G.W. Lin, J.L. Zhang, J.S. Ge, J.R. Shen (Shanghai, PR China)

A study of the main factors affecting Ni–MH battery activation 799
C.Z. Yu, G.J. Yan, W.H. Lai, Q.H. Dong (Beijing, P.R. China)

Characteristics of Ni/MH power batteries and its application to electric vehicles 804
F. Zhan, L.J. Jiang, B.R. Wu, Z.H. Xia, X.Y. Wei, G.R. Qin (Beijing, PR China)

Hot alkaline treatment on hydrogen storage alloys in sealed Ni/MH batteries 809
D.Y. Yan, Q. Cheng, T. Cui (Tianjin, People's Republic of China)

Electrochemical impedance spectroscopy study of Ni/MH batteries 814
S.A. Cheng, J. Zhang, M. Zhao, C. Cao (Hangzhou, China)

Influence of Ce and Nd contents of $Ml(NiCoMnAl)_5$ alloy on the performances of Ni–MH batteries 821
J.H. Guo, Z.T. Jiang, Q.S. Duan, G.Z. Liu, J.H. Zhang, C.M. Xia, S.Y. Guo (Liaoning, PR China)

Effect of cobalt powder on the inner pressure of Ni/MH batteries 825
L. Mao, Z. Shan, S. Yin, B. Liu, F. Wu (Zhongshan City, PR China)

Effect of Co additives on the cycle life of Ni–MH batteries 829
L. Mao, J. Tong, Z. Shan, S. Yin, F. Wu (Zhongshan City, PR China)

Fuel cells

Electrochemical properties of $Ml(NiCoMnCu)_5$ used as an alkaline fuel cell anode 833
X.H. Wang, Y. Chen, H.G. Pan, R.G. Xu, S.Q. Li, L.X. Chen, C.P. Chen, Q.D. Wang (Hangzhou, PR China)

Hydrogen transport between proton conducting oxide and hydrogen storage metal 838
S. Horiike, A. Kunimatsu, K. Takahiro, S. Nagata, S. Yamaguchi (Sendai, Japan)

Hydrogen-processing of materials

Hydrogen treatment (processing) of materials: current status and prospects 844
V.A. Goltsov (Donetsk, Ukraine)

Tensile and impact properties of mesoscopic-grained $\alpha+\beta$-type titanium alloys obtained through hydrogen treatments 858
H. Yoshimura, J. Nakahigashi (Fukuyama City, Japan)

Effect of the disproportionation and recombination stages of the HDDR process on the inducement of anisotropy in Nd–Fe–B magnets 862
S. Sugimoto, H. Nakamura, K. Kato, D. Book, T. Kagotani, M. Okada, M. Homma (Sendai, Japan)

Phase transformation and magnetic properties of $Nd_8Fe_{84}Ti_8$ alloy during HDDR process 868
B.-z. Cui, X.-k. Sun, D.-y. Geng, W. Liu, X.-g. Zhao, Z.-d. Zhang, Yu.-c. Sui (Shenyang, PR China), J.-w. Liu (Tianjin, PR China)

Ga site occupancy in HDDR-treated $Nd_2Fe_{14}B$-based alloy by XAFS 872
M. Matsuura, A. Ashfaq (Miyagi, Japan), M. Sakurai (Sendai, Japan), T. Tomida, N. Sano (Amagasaki, Japan), S. Hirosawa (Osaka, Japan)

H_2 gaseous, thermal and catalytic applications

H_2 gaseous applications

A panoramic overview of hydrogen storage alloys from a gas reaction point of view 877
G. Sandrock (Ringwood, NJ, USA)

Recent developments in hydrogen storage applications based on metal hydrides 889
V. Güther, A. Otto (Nuremberg, Germany)

Solubility and partitioning of hydrogen in metastable Zr-based alloys used in the nuclear industry 893
D. Khatamian (Chalk River, Canada)

Absorption of hydrogen isotopes by Pd–Pt alloys 900
T. Yasumatsu, J.L. Wan, M. Matsuyama, K. Watanabe (Toyama, Japan)

Isotope effects on the physicochemical properties of zirconium hydride 908
S. Yamanaka, K. Yoshioka, M. Uno, M. Katsura (Osaka, Japan), H. Anada (Amagasaki, Japan), T. Matsuda, S. Kobayashi (Osaka, Japan)

Thermal application

A multi-hydride thermal wave device for simultaneous heating and cooling 915
E. Willers, M. Wanner, M. Groll (Stuttgart, Germany)

Catalytic applications

Transfer hydrogenation of olefin from alcohol using a hydrogen-absorbing alloy ($CaNi_5$) catalyst 919
H.Imamura, T. Tanaka, Y. Sakata, S. Tsuchiya (Ube, Japan)

Author Index of Volume 293–295 923

Subject Index of Volume 293–295 927

CONTENTS direct

This journal is part of **ContentsDirect**, the ***free*** alerting service which sends tables of contents by e-mail for Elsevier Science books and journals. You can register for **ContentsDirect** online at: **www.elsevier.nl/locate/contentsdirect**